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The effect of implant design of linked total elbow arthroplasty on stability and stress: a finite element analysis

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Abstract

Several linked total elbow arthroplasty designs exist, which function similar to a loose hinge joint. Constraint behaviour is an important design consideration, as it affects joint stability, or how much secondary [e.g. varus–valgus (VV)] motion is permitted. Implant durability is also a concern, as bearing failures have been reported. This finite element analysis investigates the constraint characteristics and ultra high molecular weight polyethylene bearing stresses of three linked elbow design concepts [cylindrical (CY), hourglass (HG) and concave cylinder (CC)]. The bearing of the CY design was subjected to elevated Von Mises stresses (2.1–5.4 times higher than the HG and CC designs) due to edge loading. The HG design maintained low stresses, but was unable to provide

consistent VV stability. The CC design also maintained low stresses while providing consistent VV stability. These results suggest that CC designs may provide better stability characteristics and durability in vivo, compared to the other two designs.

Keywords::

linked total elbow arthroplasty | implant design | finite element analysis | implant stability | implant durability

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